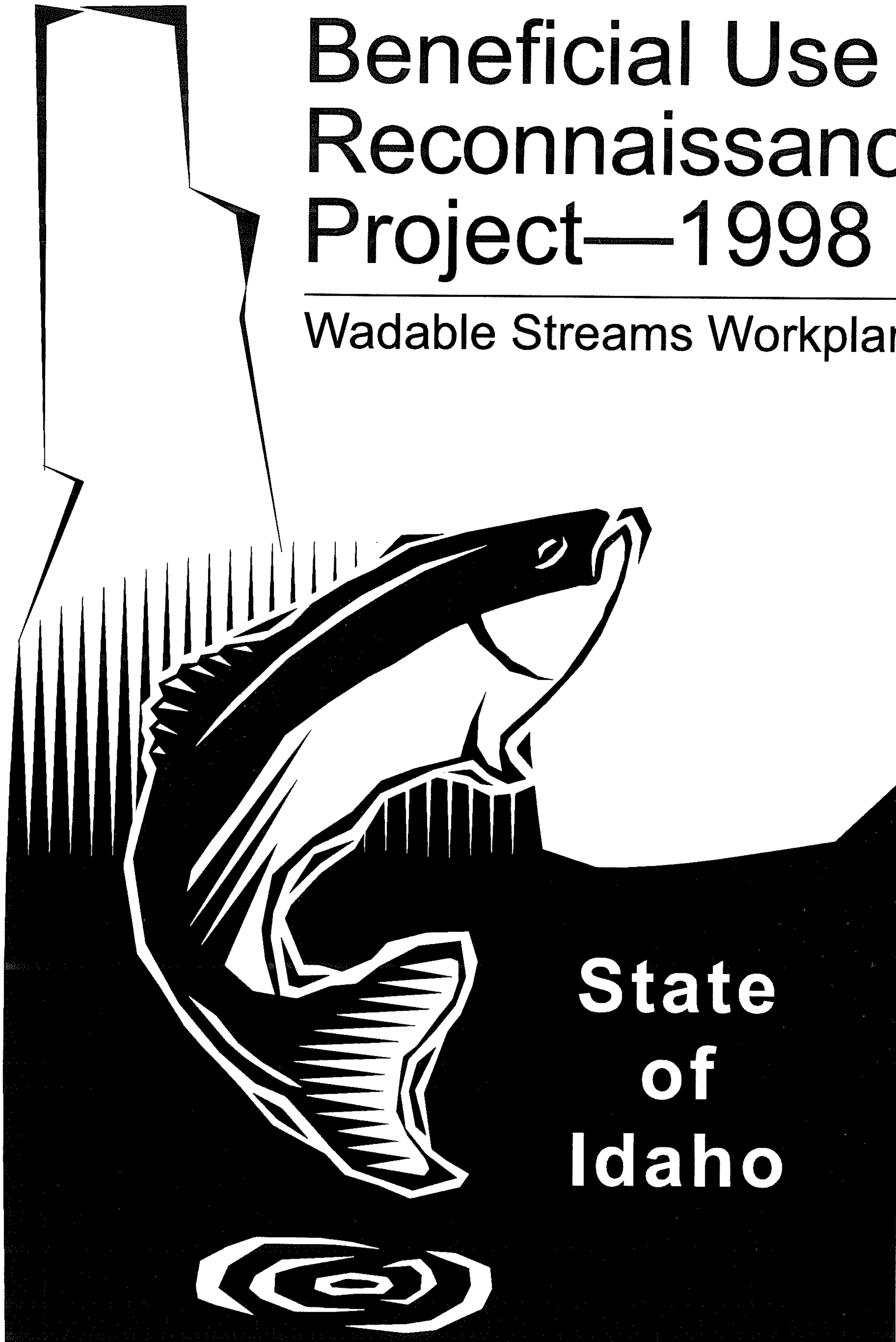
Beneficial Use Reconnaissance Project—1998

Wadable Streams Workplan



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Wadable Streams Workplan

May 1998

Prepared for
Idaho Division of Environmental Quality
by
Beneficial Use Reconnaissance Project Technical Advisory Committee

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Introduction

Creation of the Beneficial Use Reconnaissance Project

In 1993, The Division of Environmental Quality embarked on a pilot program aimed at integrating biological and chemical monitoring with physical habitat assessment as a way of characterizing stream integrity and the quality of the water (McIntyre 1993). This program was also developed in order to meet the Clean Water Act requirements of monitoring and assessing biology as well as developing biocriteria. This pilot, named the Beneficial Use Reconnaissance Project (BURP), relied heavily on protocols for monitoring physical habitat and macroinvertebrates developed by ISU and DEQ in the early 1990s. It closely followed the *Rapid Bioassessment Protocols for Use In Streams and Rivers* put together by EPA (Plafkin et al. 1989). This document was an attempt to use the best science and understanding available to characterize water quality based on biological communities and their attributes. Because of the success of the 1993 pilot, DEQ decided to expand the project statewide for 1994 (McIntyre 1994; Steed and Clark 1995). The project has remained statewide since 1994.

Purpose

The purpose of the 1998 BURP Workplan is to provide statewide consistency in the monitoring and data collection as described in the *Coordinated Nonpoint Source Water Quality Monitoring Program for Idaho* (Clark 1990).

This document only describes how to conduct data collection for the BURP process. It lays out the assumptions, methods, and equipment required. This document does not describe the analysis and interpretation of the data collected.

Interpretation of BURP data and any other relevant water-quality information is described in DEQ's Water Body Assessment Guidance (WBAG) document. The WBAG document outlines the process DEQ uses in determining: 1) existing beneficial uses, and 2) beneficial-use support status (full support, not full support).

Objectives

The primary statewide Wadable BURP Objectives for the 1998 field season are outlined as follows:

1. The state will make an effort to sample potential Reference conditions/streams.

2. The state will attempt to gain better BURP coverage in Hydrologic Units with upcoming Subbasin Assessments and Total Maximum Daily Loads.

Rational for Selected Parameters

Physical/Chemical

Flow

Minshall (1993) noted that flow was one of the principal abiotic factors shaping stream ecosystems. Nelson et al. (1992) found flow to be one of the physical attributes that distinguished streams from different geologic regions. Flow is one of a series of measurements taken by both Oregon and Washington in very similar bioassessment projects (Mulvey et al. 1992, Plotnikoff 1992). Flow patterns affect habitat characteristics such as erosion (in part), distribution of aquatic assemblages, and movement of suspended materials (Rankin 1995). Other associated parameters such as discharge and gradient, may provide useful forms of stratification (Rankin 1995). ISU used discharge at base flow to differentiate among intermediate- and large-size rivers (Royer 1997). Discharge information, particularly annual discharge data, may provide an understanding of natural flow patterns and possible impacts to biological communities.

Width and Depth

Width and depth measurements along with discharge data provide meaningful information about stream size and habitat characteristics. These variables have significant impact on the distribution of the aquatic community. Further, grouping rivers by width and depth may be useful for data comparison purposes (DEQ 1996 a).

Shade

Canopy cover is a surrogate for water temperature since vegetation controls the amount of sunlight reaching the stream (Platts et al. 1987). Canopy cover was found to be an important variable in studies by Mulvey et al. (1992) and Overton et al. (1993). Temperature and canopy cover helped explain differences in fish occurrence and abundance in these studies as well as in the Robinson and Minshall (1992, 1994) ecoregion studies.

Substrate

Sediment and its accumulation is detrimental to salmonid spawning (a beneficial use) since it limits the quality and quantity of the inter-gravel spaces that are critical for egg incubation (Maret et al. 1993, Young et al. 1991, and Scrivener and Brownlee 1989). Fine sediment and availability of living space have direct affect on both fish and insects (Marcus et al. 1990, Minshall 1984). Several studies and state projects have found relative substrate size to be important indicators of water quality effects due to activities in the watershed (Overton et al. 1993, McIntyre 1993, Skille 1991).

Habitat Types

An evaluation of habitat diversity is critical to any assessment of ecological integrity. Water velocity, in conjunction with depth, has been demonstrated to have a direct influence on the structure of benthic (Osborne and Hendricks 1983; as cited in Plafkin et al. 1989) and fish (Oswood and Barber 1982) communities. Chapman (1966) stated the physical habitat regulates fish abundance. Researchers have correlated various components of the physical habitat with fish abundance and denoted habitat type as an important factor (Hunt 1969, Graham et al. 1980, Fraley et al. 1981, Shepard et al. 1982, Shepard 1983, Pratt 1984, Irving 1987, Hoelscher and Bjornn 1989, Moore and Gregory 1989). Gorman and Karr (1978) took this relation one step further and found fish diversity, as well as abundance, increased with habitat diversity.

Bank Stability

The removal of stream bank vegetation and soils reduces the structural stability of the stream channel and negatively affects fish productivity (Platts, 1990; Platts & Nelson, 1989). Banks stabilized by deeply rooted vegetation, rocks, logs, or other resistant materials are less susceptible to flow related erosion, reduce water velocity along the stream perimeter, and aid in beneficial sedimentation (Bauer & Burton, 1993).

Riparian Vegetation

The presence and condition of the riparian vegetation is important to the overall ecological health of the river and its floodplain. Healthy stands of riparian vegetation provide habitat for aquatic and terrestrial animals, as well as perform important physical functions (e.g. erosion control, sediment catchment). Stands of naturally occurring riparian vegetation can vary from river to river depending on climate and geomorphology. Idaho rivers, with broad floodplains, will typically have large, continuous stands of cottonwoods. Others may have shrubs (willows, river birch) or more grass-like meadows.

Pool Complexity
Pool complexity is a measure of pool quality and pool to riffle ratio is a measure of pool quantity. In a study of streams that differed by the amount of management in their watersheds, Overton et al. (1993) found pools in the less impacted watersheds were more frequent, had higher volumes, and were of greater depth than those in the more impacted watersheds. Beschta and Platts (1986) suggested that pool quality is equally as important as the number of pools in describing a healthy stream from a fisheries standpoint.

Large Woody Debris
Large Woody Debris (LWD), sometimes referred to as "large woody debris", has been found important in smaller sized streams where the riparian zone consists of evergreens, i.e., forested areas (Everest et al. 1987). Large organic debris has been found to be important for the complexity it adds to stream habitats, retention of allochtonous matter and sediment, and stability it imparts to streams under high flow conditions. Some species of salmonids show a high affinity for LOD (Rieman and McIntyre 1993).

Photo Documentation and Diagrammatic Mapping
Photographic records provide visual details concerning riparian conditions and river geomorphology. Diagrammatic mapping is a representative map of the sampling reach. The map provides visual information and an approximate scale of important stream characteristics such as land use, geomorphic channel units, habitat features, and bank conditions (Meador et al. 1993). Such visual details compliment field notes and habitat measurements. This type of documentation may also provide baseline information concerning qualitative changes of riparian conditions, land use and river channel modifications.

Stream Channel Classification
Streams in Idaho exhibit considerable variability in climates, hydrology, geology, land forms, and soils. Recognizing this, the TAC elected to use Rosgen's (1994) Stream Classification System as a means of organizing and stratifying streams for comparison. As Conquest et al. (1993) noted, "One way to organize an inherently variable landscape is to employ a system of classification. The general intent of the classification is to arrange units into meaningful groups in order to simplify sampling procedures and management strategies."

Conductivity
Conductivity, or specific conductance, refers to the ability of water to conduct an electrical current. It is an indication of the concentration of dissolved solids. Kunkle et al. (1987) found conductivity to be an useful indicator of mining and agricultural effects. Royer and Minshall

(1996) found sites designated as degraded generally had higher conductivities. Maret et al. (1997) reported conductivity is one environmental factor determining the distribution of fishes.

Biological

Macroinvertebrates

Macroinvertebrates are an essential part of the BURP process. This biological community reflects a stream's overall ecological integrity. Because most streams are monitored infrequently, chemical monitoring is not always representative of the long term condition of the stream. Biological monitoring provides an integrated representation of water conditions and provides better classification of the stream's condition and support status because the biological community is exposed to the stream's condition over a long period of time. This biological assemblage is a useful assessment tool because it is ubiquitous, includes numerous species, and responds to physical and chemical impacts in the water column (Rosenberg and Resh 1993). Additionally, macroinvertebrates with certain environmental tolerances may provide some insight of pollutants (Johnson et al. 1993).

Fish

Fish contribute significantly to the ecology of the aquatic community. This biological assemblage is highly visible to the public and is an important economic resource in Idaho. Additionally, fish have relatively long life spans which can reflect long term and current water quality conditions. Due to their mobility, fish also have extensive ranges and may be useful for evaluating regional and large habitat differences (Simon and Lyons 1995).

Periphyton

Periphyton is a useful indicator because of its wide distribution, numerous species, and rapid response to disturbance (EPA 1996 b). Periphyton integrates physical and chemical impacts because it exists in the water column. Diatoms, a type of periphyton, have frequently been identified as useful biological indicators particularly in Montana, Kentucky, Oklahoma, and European countries (Round 1991, Rosen 1995). Periphyton supplements fish and macroinvertebrate information because of differences in trophic levels, motility and life history (Allen 1995). Additionally, if current fish information is unavailable for a particular river, there will still be data from two other biological assemblages (periphyton and macroinvertebrates) to determine certain support statuses.

Fecal Coliform

Fecal coliform, although not a pathogen, is typically an indication of pathogens in the water column. Most large rivers support primary and secondary contact recreation. The State of

Idaho has set water quality standards to protect primary and secondary contact recreation beneficial uses (IDAPA 16.01.02.250.01) through numerical criteria such as fecal coliform.

Existing Data Review

Review of other data is important when analyzing different water bodies. This cost-effective step should be performed for each sampling reach. As part of the "preplanning" process, the regional office contact should check for available data at resources such as:

- Idaho Department of Fish and Game
- Idaho Division of Health (Health Districts)
- Idaho Department of Water Resources
- Idaho Division of Environmental Quality (internal sources)
- Bureau of Land Management
- Bureau of Reclamation
- Natural Resource Conservation Service
- Tribal Nations
- Universities
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Geological Survey
- EDMS (IDWR)
- STORET (EPA)
- Internet searches (if access available)
- GIS coverages from DEQ and other agencies
- Hydropower companies
- Other appropriate resources

Each BURP site must have fish data that is less than five years old. A search for this data is required. The site must be electrofished if no data less than five years old is available and no ESA conflicts arise.

Core Parameters

Core parameters will be measured consistently statewide to obtain reliable and comparable data. Measures were selected based on the goal to assess beneficial use support status of wadable streams rapidly and cost-effectively. A table in the methods section lists the core parameters, method references, and levels of intensity for each type of waterbody. Some measures directly evaluate beneficial uses while others are surrogate measures for uses that cannot be directly assessed at a reconnaissance level. A (Q) after the parameter indicates that it is a quantitative measurement, while a (S) signifies a subjective (or qualitative) measurement.

Wadable Stream Methods

Criteria to use Wadable Stream Methods

For lotic systems, one of the following criteria must be met:

- Is the entire sampling reach safely wadable?
- Can the entire protocol for wadable streams be performed?

If the answer is "yes" to either question, then the wadable stream protocol should be used.

Site Selection

Idaho has many diverse environments within its borders. Thus, criteria for selecting streams to monitor must be flexible enough to address the range of conditions encountered. To assist in prioritizing monitoring efforts, the TAC identified the following categories of streams to be considered when the Regional Offices select streams for monitoring:

- Potential reference streams
- Streams attributing to improved BURP coverage in Hydrologic Units with upcoming Subbasin Assessments and Total Maximum Daily Loads

The convention for naming streams follows the "Geographic names information system (GNIS) Idaho." (U.S. Geological Survey 1995).

Stream Site Selection

The placement and number of BURP sites is a difficult issue to address in a consistent statewide method. There are two major factors that BURP coordinators have identified in selecting sites for monitoring, representativeness, and access.

Representativeness

To apply conclusions to longer stream reaches or entire streams the sample sites must be representative. This sampling can be accomplished by:

1. a "preplanning" office step, which may involve consulting with other resource agency representatives, searching and examining existing stream data, investigating aerial photos;
2. selecting several reaches that cover the potential range of variability determined above; and
3. selecting a few sites in the field that are determined to be the most representative of the stream reach or entire stream.

Robinson and Minshall (1992, 1994) reported ecoregion (Omernik and Gallant, 1986) stratification represented real differences in biotic communities. Currently the BURP process uses ecoregions to stratify streams for comparison to reference conditions.

Ecoregional boundaries are represented by lines on a map. These boundaries do not always depict a sharp change, but rather a gradational change in ecology. When determining which ecoregion a sample site is located within, and the sample site is near a ecoregional boundaries, it is suggested that you evaluate which ecoregion type is most representative of that site.

The DEQ Guidelines for Determining Beneficial Use Attainability and Support Status (draft document, October 6, 1994) recommends that BURP reaches should not represent multiple stream orders. In other words, if a stream has three orders, then at least one reach per order must be established to determine beneficial use attainability and support status for the entire stream. Regional BURP Coordinators should consider both Rosgen stream type(s) and stream orders in choosing reaches for BURP crews to assess.

Methods

Table 1. 1998 Core Parameters List for Wadable Streams

Parameter	Method Reference	Level of Intensity
Flow (Q)	Harrelson et al. 1994.	one measurement per site; set interval method
Width/Depth (Q)	Bauer and Burton 1993. pg. 86	measure wetted and bank full conditions at three locations

Parameter	Method Reference	Level of Intensity
Shade (Q)	Bauer and Burton 1993. pg. 68	measure with a densiometer at three riffle habitat units; use habitat types and lengths to weight calculations for stream site shade calculations
Bank Stability (S)	Bauer and Burton 1993. pg. 98	longitudinal (total stream site length) for both stream banks
Substrate (Q)	Wolman 1954	at three riffle habitat units; a minimum of 50 counts per riffle; set interval method
Habitat Types (S)	modified from Schuett-Hames et al. (1992) and Dolloff et al. (1993)	Determine the type of habitat units present along the longitudinal stream axis. Wetted portions of the main channel are assigned to one of the four habitat types.
Pool Complexity (Q,S)	Bauer and Burton 1993. pg. 119	measurements taken in a minimum of four pools, length, maximum width, maximum depth, and depth at pool tailout
Large Woody Debris (Q)	Platts et al. 1987. pg. 83	LOD > ten centimeters diameter and > one meter in length; within bank full zone of influence (applicable only in forested situations)
Stream Channel Classification (S)	Rosgen 1994	to letter classification only (A,B,C, etc.)
Habitat Assessment (S)	Hayslip 1993	follow habitat assessment protocol
Temperature (Q)	Franson 1995	instantaneous temperature measurements
Photopoints (Q)	Cowley 1992	photographs upstream and downstream at lower end of each site; record directions in which photographs are taken
Conductivity	Hydrolab Corp. 1993	Measure each parameter at transect 1 using a Hydrolab© unit.
Latitude/Longitude (Q)	Trimble 1995	collect uncorrected GPS (raw) data

Parameter	Method Reference	Level of Intensity
Biological Parameters		
Macroinvertebrates (Q)	Clark and Maret 1993	Hess sampler, with 500 μm mesh at three riffle habitat units (n=3); samples preserved and stored separately in the field; laboratory personnel composite the three samples, count, and identify the first 500 individuals; Surber samplers used if conditions do not permit use of a Hess sampler
Fish (S)	Modified from Chandler et al. 1993	collect fish in the study site or an equivalent length of stream which includes all habitat types encountered in the study site; collect, count, and voucher specimens (6 individuals if possible, or as the permit allows) for each species; measure total length of all salmonids

Description of Method Modifications

Flow

Locate a straight non-braided stretch of your sampling reach. Place a measuring tape across the stream perpendicular to the flow. Take evenly spaced velocity measurements from wetted bank to wetted bank so that no more than 5% of the total discharge is in each (partial cross-section) (Harrelson et al., 1994). Record the horizontal distance measured from the tape and record depth and velocity from the top-setting wading rod and electromagnetic velocity meter. On very narrow streams with homogenous depth and substrate, >10% of the total discharge in any partial cross-section, or cell, is acceptable for reconnaissance level monitoring purposes. Also note: for depths ≥2.5 feet, two velocity measurements are taken for each partial cross-section; one at 20% of total depth and a second at 80% of total depth.

Width/Depth

Although high accuracy using measurement methods for streams < 100 feet wetted width has been reported (Platts et al., 1983) the following protocol was developed to provide meaningful resolution without the encumbrance of multiple measurements.

At each BURP site a transect is established 10 meters upstream of each macroinvertebrate collection location. Procedure is conducted from the left bank to the right bank while facing upstream.

- Stretch, secure, and level tape across bank full (BF) width.
- Measure and record BF width.
- Measure and record the vertical distance from the tape at BF elevation to the left wetted edge (LWE).
- Measure and record wetted width (WW).
- Measure and record wetted depth (WD) from the water surface to the channel bottom at evenly spaced increments across the wetted width according to the following guideline: (intervals calculated by WW divided by n+1)

WW	# measurements(n)
$\leq$ 1 meter	3
> 1 but $\leq$ 4 meters	5
> 4 meters	7

- Calculate and record average wetted depth (AWD).

When a width/depth transect is measured in a split channel, there are two ways to make the measurement. Bank full measurements should be taken in the channel with the most discharge if the area between the channels is above the ordinary high water level. Bank full measurements should be taken across both of the channels if the area between the channels is below the ordinary high water level.

Shade

Use a concave spherical densiometer to determine canopy cover. The number of densiometer grid intersections obstructed by overhead vegetation is recorded. Densiometer readings are taken at three riffle habitat units. Densiometer measurements should be taken on the riffle relative to where the macroinvertebrate samples were taken. For stream orders 1-4 the following four readings are taken per cross section; right bank, left bank, from the center of the stream facing upstream, and from the center of the stream facing downstream. The densiometer should be held one foot above the water surface for all measurements and one foot in from the banks when taking right and left bank measurements (see Figure 1).

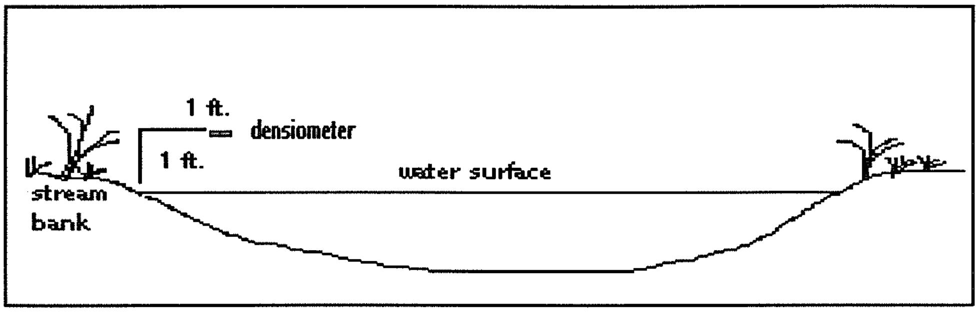

Figure 1. Position of densiometer when measuring at right and left wetted edges (1 ft in from stream bank and 1 ft above water surface; facing the bank).

Stream Bank Stability

Using a modified version of Platts, Megehan & Minshall (1983), the stream bank is categorized as covered and stable, covered and unstable, uncovered and stable, or uncovered and unstable. Banks are defined as covered if they are typified by a 50% coverage of perennial vegetation or their roots, rocks of cobble size or larger, or logs greater than four inches is diameter (Bauer & Burton, 1993). Banks are defined as unstable if they are typified by fractured banks, bank slumping, or vertical and eroding banks (Bauer & Burton, 1993).

Stream bank condition is determined on the left bank and the right bank of the waterbody. Using a two meter stick or a tape, the BURP crew measures the total number of meters of stream bank that fall into each of the four categories. These values are used to calculate what percent of the reach is characterized by each of the four bank conditions.

Substrate

The BURP process has used a modified Wolman Pebble Count (Wolman 1954) to quantify substrate size distribution in riffle habitats. This BURP pebble count method relies on surface fines (defined as material <6.35 mm Chapman and McLeod 1987) as an index of sedimentation and beneficial use impairment.

Pebble counts (substrate measurements) are conducted at the same three riffle habitat units where macroinvertebrates were sampled. Begin at the bank full level on one stream bank and proceed across the riffle to the bank full level on the opposite stream bank. Select pebbles at equal distant intervals (heel to toe, one pace, each foot on a tape, etc.). At each interval, reach to the stream bottom, pick up the first particle touched, and measure the intermediate axis. Record on the BURP Field Form the size class of the particle and whether the particle was chosen from within the wetted stream channel. Replace the particle down stream of the transect line. Conduct the pebble count with as little bottom disturbance as possible. A minimum of 150 particles measured from three riffles (50 per riffle) is required. Record measurements until the bank full streambank is reached, even if the 50 counts are reached before a transect is completed. Each successive pass must be upstream from the previous pass if multiple passes are required to reach the minimum 50 pebbles per riffle.

Habitat Typing

A variety of habitats occur in wadable streams. Visual determination of habitat units can be subjective with poor precision because they are not clearly defined (Platts 1982). The Western Division of the American Fisheries Society formed a committee to standardize definitions related to habitat evaluations (Helm et al. 1985). Others have combined types into macrohabitat units thereby improving observer recognition and the ability to replicate surveys in the future (Schuett-Hames et al. 1992). Macrohabitat units have equivalent structure, function, and responses to disturbance.

Oswood and Barber (1982) proposed four general categories or macrohabitat units based on velocity and depth relations: slow and deep, slow and shallow, fast and deep, and fast and shallow. These correspond to pools, glides, runs, and riffles. These habitat types will be differentiated by the following characteristics.

- **Pool-**A portion of the stream with reduced water velocity, water deeper than the surrounding areas, the bottom often concave in shape forming a depression in the profile of the stream's thalweg, and that would retain water if there were no flow. Pools usually occur at outside bends (e.g. lateral scour) and around large obstructions (e.g. plunge pool). Pocket water pools refer to groups of small pools often in areas of otherwise fast or turbulent flow, usually caused by eddies behind boulders or other obstructions. Eddies are also associated with backwater pools. Water impounded upstream from channel blockage, typically caused by a log jam or beaver dam, is classed a dammed pool. Flats are actually a wide shallow pool often confused with a glide. Pools end where the stream bottom approaches the water surface, also known as the pool tailout.

- **Glide-** A portion of the stream with slow moving, relatively shallow water. The waters surface has little or no turbulence and the stream bottom is flat or slightly convex in shape lacking the scour associated with the pool. Glides are typically situated downstream of pools in the transition between the pool and the crest of the riffle. The riffle crest restricts water flow and slows the water in glides. Glides also occur where the channel widens allowing the stream to shallow and slow. Glides are most commonly found in low gradient streams associated with elongated pools.

- **Riffle-** A portion of the stream with swiftly flowing, shallow water. The waters surface is turbulent. The turbulence is caused by completely or partially submerged obstructions, often the stream bottom. Cascades are one class of riffle characterized by swift current, exposed rocks and boulders, considerable turbulence, and consisting of stepped drops over steep slopes. Riffles that are swift, relatively deep, and have considerable surface turbulence, sometimes represented by standing waves, are called rapids. Rapids at high flow may be confused with runs.

- **Run-** A portion of the stream with swiftly flowing, relatively deep water, which approximates uniform flow. There are no major flow obstructions causing little or no surface turbulence. Runs tend to occur immediately upstream and downstream of riffles. Pool tailouts are typically classed as runs in small, high gradient streams. A narrow, confined channel through which water flows rapidly and smoothly, usually with a bedrock substrate, is called a chute. Chutes are a class of runs.

The classification of habitat units is geomorphic and flow dependent and may change with a change in discharge. It is recommended the observer "calibrate" their eye to the type of stream (e.g. spring creek, freestone creek) and local conditions; form a mental image of the various habitat types that should persist given the current conditions.

Once "calibrated", determine the type of habitat units present along the longitudinal stream axis. Wetted portions of the main channel are assigned to one of the four habitat types. Complexes of multiple habitat units may be encountered. Individual habitat types should be recorded if the unit occupies more than 25% of the wetted channel width. Minor habitat units should be combined with the adjacent unit.

Pool Complexity

Pool complexity is measured at a minimum of four pools if pools are present at the site. Pool length, substrate, overhead cover, submerged cover, bank cover, maximum pool depth, maximum pool width, and depth at pool tailout are measured at each pool.

Large Woody Debris

All LWD greater than ten centimeters in diameter and one meter in length is counted within the bankfull channel throughout the site. The requirements for minimum diameter and length are provided on the field form. This parameter only applies to streams in forested situations.

Occasionally, sites will be encountered with large accumulations of LWD. At these sites, it is acceptable to count up to 100 pieces than estimate thereafter, i.e., <100 pieces of LWD in site, count individually, >100 pieces in site, count by tens. When dealing with large amounts of LWD each piece counted must meet the minimum size requirement.

Photo Documentation

Each crew is supplied with slide film, date back cameras, and compasses. Two photos are taken of the stream site from the lower end of the site. One photo is taken facing upstream and one facing downstream. Recording the azimuth in which each photo is taken is optional.

Stream Channel Classification

Determine the Rosgen stream type to letter only. Determine the following:

- Latitude
- Longitude
- Elevation
- Slope
- Stream Order
- Valley Type

Additional descriptive items that may be collected in the field or in the office before and after the assessment is made.

- Aspect
- Lithology

Conductivity

The crew is to measure conductivity at transect 1 using a Hydrolab© unit or YSI model 30 hand held salinity, conductivity, and temperature system.

Macroinvertebrates

Macroinvertebrate samples are collected from three separate riffle habitat units following Clark and Maret (1993). Using a Hess sampler take an invertebrate sample by stirring substrate and brushing rocks for a minimum of two minutes (strive for a consistent time of 3-5 minutes per sample). Place the sample into a container, label inside and out, and preserve with 70% ethanol (container should be ½ to ¾ full). If container is greater than 50% full of sample material, contents should be divided into two containers of fresh alcohol or rinsed with 70% ethanol three times within 24 hours.

Each of the three samples will be preserved separately for laboratory compositing. The first 500 individuals will be counted and identified.

Fish

The collection of fish is an **optional** parameter for the 1998 BURP season. If applicable fish data less than five years old exists for the BURP reach, the site does not need to be electofished.

Core Methods

- Obtain fish collection permit or cooperate electrofishing effort with permitted personnel.
- The site surveyed for fish should include all habitat types present in the reach if different than the BURP site.
- Electrofish the site. Electrofish after macroinvertebrates have been collected and before habitat measurements are taken if a BURP site.
- The survey should include one upstream pass without block nets as a minimum reconnaissance level effort. Proceed up the thalweg of the channel for streams less than five meters wetted width and in a zig-zag pattern on larger streams. Sample all habitat types.
- Collect all fishes.
- Prepare equipment to measure length (weight scales optional) and recovery chamber prior to applying anesthesia.
- Apply anesthesia as recommended in Chandler et al. (1993).
- Measure total length of each fish of the family Salmonidae. Salmonids occurring in Idaho include rainbow trout/steelhead trout, cutthroat trout, rainbow/cutthroat trout hybrids, brook trout, bull trout, brook/bull trout hybrids, brown trout, brook/brown trout hybrids (tiger trout), lake trout, brook/lake trout hybrids (splake), golden trout, kokanee/sockeye salmon, coho salmon, chinook salmon, lake whitefish, mountain whitefish, Bear Lake whitefish, pygmy whitefish, Bonneville whitefish, Bonneville cisco, Atlantic salmon, and arctic grayling. If hundreds of young-of-the-year are collected, a random subsample of the total catch of each salmonid species may be measured for total length. All young-of-the-year should be counted.
- Count each fish of non-Salmonidae families collected.
- Voucher up to six (6) specimens of each species as the fish collection permit allows. Voucher according to Appendix IV. Make a one inch incision along the right side of fish greater than 250 mm.
- Record the amount of electrofishing effort (time) spent on the site. Record the effort (time) for each pass if multiple passes are made.
- Record the proportion of habitat types within the site on the fish data sheet if different than the BURP site.
- Record stream length and average width (minimum of three transect measurements) of the site electrofished if different than the BURP site.

Optional Methods

- Closed population or mark-recapture assessment methods using block nets and multiple passes.
- Weigh each fish of the family Salmonidae. Salmonids occurring in Idaho include rainbow trout/steelhead trout, cutthroat trout, rainbow/cutthroat trout hybrids, brook trout, bull trout, brook/bull trout hybrids, brown trout, brook/brown trout hybrids (tiger trout), lake trout, brook/lake trout hybrids (splake), golden trout, kokanee/sockeye salmon, coho salmon, chinook salmon, lake whitefish, mountain whitefish, Bear Lake whitefish, pygmy whitefish, Bonneville whitefish, Bonneville cisco, Atlantic salmon, and arctic grayling. If hundreds of young-of-the-year are collected, weigh the total catch of each salmonid species collectively. All young-of-the-year should be counted.
- Record length and weight of all non-Salmonidae fishes.

Recommended Procedure Sequence For Site Evaluation

- Take pre-field steps to gather all existing chemical, physical habitat, and biological data residing with other federal and state agencies or entities, with the aim of identifying potential sampling sites.

- Determine the appropriate site to survey in the field. The minimum site length should be 20 times the wetted width or 100 meters, whichever is larger.

- Measure the appropriate distance and mark beginning and ending points with flagging, being careful to stay out of stream. The downstream end of the measured length of stream is considered the beginning.

- Take photographs of the site and record GPS coordinates, photo point, and map location.

- Take bacteria samples if the holding time (23 hours) permits.

- Measure conductivity.

- Fill out the descriptive cover sheet information, i.e., stream slope and Rosgen stream type, stream order, crew members' names, weather, location relative to some reference landmark, stream temperature (measured with a thermometer), general observations, etc.

- Measure stream discharge by choosing a location with a relatively straight channel and uniform flow, where possible.

- Locate the first riffle upstream from beginning point.

- Randomly select a location for macroinvertebrate sampling following these steps:

  1. stretch a tape along one bank from the lower to the upper end of the riffle;

  2. generate a random number on the tape;

  3. stretch the tape across the riffle at this random location; and

  4. generate a random number and locate on "cross-riffle-tape" and place the sampler (Hess or Surber) at that location.

- Take an invertebrate sample.

- Conduct fish sampling (electrofishing, et cetera) if it is to be done.

- Conduct a pebble count immediately upstream from the macroinvertebrate sample transect.

- Take canopy closure (shade) measurements at the riffle habitat unit transect where macroinvertebrates were sampled. Measure at right and left bank and in the middle of stream facing upstream and another facing down stream.

- Measure width and depth of the stream 10 meters above the riffle habitat unit transect where macroinvertebrates were sampled.

- Proceed to a mid-site riffle habitat unit and repeat macroinvertebrate sample, pebble count, canopy closure and width/depth measurements

- Proceed to a upper-site riffle habitat unit and repeat macroinvertebrate sample, pebble count, canopy closure and width/depth measurements

- Conduct habitat type measurements by measuring and characterizing as either pool, riffle, run, or glide. Express this on the field forms by percent of total length surveyed.

- Assess pool complexity at a minimum of three pools within the site. Follow the pool definition described under "Habitat Types" in selecting pools.

- Conduct a bank stability survey by rating each bank for the four different categories noted on the field forms; covered and stable, covered and unstable, uncovered and stable, and uncovered and unstable. Express ratings as percentages. Use the tape that was used for obtaining the riffle/pool measurement or use a two meter pole.

- Complete the Habitat Assessment form at the site.

Quality Assurance and Quality Control

Quality Assurance

Collection of reliable and accurate monitoring and measurement data is the goal of the quality assurance (QA) program in the BURP process. The five aspects of DEQ's quality assurance program aimed at enhancing reliability, accuracy, and consistency are: 1.) crew supervision, 2.) regional BURP Coordinator Workshops, 3.) regional crew training, 4.) Site Replication Workshops, and 5.) field reviews.

Crew Supervision

Each BURP crew is provided with supervision throughout the monitoring season. The DEQ Regional BURP Coordinators are involved during the training period and then accompany crews at least one day per week throughout the monitoring season. BURP Coordinators are trained annually through the BURP Coordinator Workshops where they are refreshed on BURP protocol, learn new BURP methods, and exchange ideas on improving data collection efficiency and accuracy.

Coordinator Workshop

A coordinator workshop is conducted prior to each monitoring season. The workshop provides:

- transfer of training materials and instruction methods;
- training on new methods; and
- statewide consistency of monitoring methods.

The DEQ central office staff coordinate and facilitate these workshops. Each DEQ Regional BURP Coordinator and Central Office BURP staff is randomly assigned parameters to present at the workshops. Presentations include:

- a copy of the relative sections of referenced protocol;
- printed recommendations of training methods; and
- an example of properly recorded measurements.

The materials presented at these workshops are combined into an annual reference document that is used in regional crew training. These workshops include training on all the existing BURP methods plus new or modified methods.

Crew Training

Following the BURP Coordinator Workshop, DEQ Regional BURP Coordinators conduct training of crews within their regions. The regional crew training covers all aspects of the BURP process whether training is a refresher for veteran crew members or first time for new crew members. Training provides a chance for hands-on experience in each parameter for each BURP crew member. Regional crew training requires at least two days including one day in the classroom and one day in the field.

Field Audits

A field audit consists of the DEQ Watershed Monitoring and Analysis Bureau staff, accompanied by a Regional Office Coordinator from an adjacent region, observing BURP crews performing measurements and collecting samples from a site. Audits are scheduled to occur within approximately two weeks of crew training. Each crew will have at least one audit per season. During a field audit, the audit team will inspect a crew measuring, collecting, and preserving samples. The audit team, using predefined standards, will determine whether or not data generated from the audited monitoring effort is acceptable.

Unacceptable efforts will be rated as either **minor** or **major**; minor meaning the data can be corrected, major meaning a serious breech of protocol has occurred and the data has been compromised in some fashion. An example of minor may be a simple recording error, for instance recording 10 when 0.1 was the correct number. An example of major would be sampling macroinvertebrates from a pool habitat or measuring pool and run habitat types and attributing the remainder to riffle. Data labeled as major will be taken before the TAC to determine if it can or cannot be used.

A briefing will be provided and a report prepared, by the DEQ Central Office staff immediately following the field audit. This report will be provided the DEQ Regional Monitoring and Technical Support Supervisors, DEQ Regional BURP Coordinator, and the DEQ Watershed Monitoring and Analysis Bureau Chief.

Biological

Macroinvertebrates

Care should be taken not to damage the invertebrates during all phases of sample collection.

All sample handling of macroinvertebrates in the field should all be done over a white pan. This includes the process of transfer of the sample from the net to the sample container. Any sample that is found in the white pan following sample processing can be washed into the sample bottle with ethyl alcohol (ETOH). The macro invertebrates must be preserved in 70% ETOH. If the sample is high in organic matter or water it may need to be preserved with a higher strength of ETOH. In addition, if the sample contents fill the sample container to a level greater than 50% the sample should be divided into two or more containers. In cases where a single sample is divided into more than one container the sample labels and field data forms should clearly reflect the sample identity.

After sampling is completed at a given transect, all brushes, nets, and other items that have come in contact with the sample must be rinsed thoroughly, examined carefully, and cleaned of any algae or other debris. All equipment should be examined again prior to use at the next BURP site and recleaned if necessary.

The sample labels must be on archival grade heavy paper that is able to withstand storage in alcohol (we recommend Resistall Paper 36#). Alcohol proof ink must be used for the field information that is entered onto the label. A label should be placed inside the jar as well as taped to the outside of the jar.

Laboratory

Laboratory QA/QC is addressed in the scope of the 1998 macroinvertebrate identification and enumeration RFP. Standard taxonomic effort (STE) is an important aspect of the laboratory analysis of macroinvertebrate samples (Plotnikoff and White 1996). The State Laboratory and/or its designees follow Plotnikoff and White (1996) to determine STE for macroinvertebrate groups in Idaho.

Voucher specimens of all organisms collected are stored in glass vials of 70% ETOH (Clark and Gregg 1986) with proper locality, date, collector, and determination labels. These specimens are then available for any later verification that might be needed and for future research opportunities. The specimens are deposited in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell.

Fecal Coliform

The Regional Offices will perform quality assurance on all the collected samples. Quality assurance for bacteria sampling involves using field blanks. On every sampling date, a "BLANK" sample container accompanies the empty sample containers into the field. At one designated site, the "BLANK" is opened for a few seconds. This procedure duplicates handling, storage and transportation of sample containers.

All samples are submitted to the designated laboratory within 24 hours of collection. The samples are placed on ice and cooled to approximately 4°C for transportation. If necessary, samples are stored in a "sample storage refrigerator" at the nearest DEQ regional office.

Proper labeling and field documentation are conducted to demonstrate compliance with sampling protocol and to reduce mishandling of sample bottles. A chain of custody is given to the receiving laboratory to assure proper sample transfer.

Quality Assurance and Data Handling

Data handling by BURP crews and Coordinators prior to submittal to Central Office is considered part of the sampling process. Once received by the CO the data enter the data handling process. Specifics of the QA for data handling can be found in the most recent version of Procedures and Guidelines for QA/QC of 1998 Beneficial Use Reconnaissance Project (BURP) Data (DEQ, 1998). Generally, the QA process requires review of data sheets by the DEQ Central Office QA crew and data entry by the DEQ's Information Services Bureau.

Lab Process

Laboratory QA is addressed in the "request for proposal" for macroinvertebrate and fish identification. The Idaho Bureau of Laboratories can provide more information [(208) 373-0257].

Safety and Training

All BURP crew members, Regional Coordinators, and Central Office Technical Team staff will be trained and certified in cardio-pulmonary resuscitation. This requirement will increase safety during electrofishing, training, and BURP field work. The BURP crews can be trained by the DEQ "in-house" or certification can be a hiring requirement. For electrofishing safety procedures see appendices IV-VI. For safe handling of formalin see Appendix IX.

Additional requirements will include competent boat handling and swimming skills for Large River, Lake and Reservoir crews.

Data Analysis and Interpretation

This document describes how to conduct a survey following the BURP process. It merely lays out how a BURP survey is conducted: assumptions, methods, data handling, and equipment required. This document is not intended to describe the analysis and interpretation of the data collected.

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Glossary

abiotic - applied to the non-living, physical, and chemical components of an ecosystem, as distinct from the biotic or living components.

attainable use - a beneficial use that, with improvement, a waterbody could support in the future

beneficial use - any of the various uses that may be made of water, including, but not limited to, water supply (agricultural, domestic, or industrial), recreation in or on the water, aquatic biota, wildlife habitat, and aesthetics.

criteria - either a narrative or numerical statement of water quality on which to base judgement of suitability for beneficial use.

designated use - a beneficial use listed for a waterbody or waterbodies in a state's water quality regulations.

discharge - commonly referred to as flow, expressed as volume of fluid per unit time (e.g. cubic feet per second) passing a particular point, in a river or channel or from a pipe.

existing use - a beneficial use actually attained by a waterbody on or after November 28, 1975.

eutrophication - the process of nutrient enrichment in aquatic systems, such that the productivity of the system is no longer limited by the availability of nutrients. This is a natural process but may be accelerated by human activities.

integrity - the extent to which all parts or elements of a system (e.g. aquatic ecosystem) are present and functioning.

monitoring - to check or measure water quality (chemical, physical, or biological) for a specific purpose, such as attainment of beneficial uses.

nonpoint source - referring to pollution originating over a wide geographical area, not discharged from one specific location.

point source - any discernable, confined, or discrete conveyance of pollutant, such as a pipe, ditch, or conduit.

pollution - any alteration in the character or quality of the environment due to human activity that makes it unfit or less suited for beneficial uses.

reconnaissance - an exploratory or preliminary survey of an area.

reference conditions - conditions which fully support applicable beneficial uses, with little impact from human activity and representing the highest level of support attainable.

surface water - the collection of all natural bodies of water, including but not limited to streams, lakes, and wetlands, evident on the surface of the land.

waterbody - a specific body of water or geographically delimited portion thereof.

water quality -a term for the combined chemical, physical, and biological characteristics of water which affect its suitability for beneficial use.

wastewater - treated or untreated sewage, industrial waste, or agricultural waste and associated solids.

thalweg - a line joining the deepest points along successive cross-sections of a river channel.

Appendix I. Field Equipment Check List

Equipment Description	Yes	No
MACROINVERTEBRATE SAMPLE EQUIPMENT		
Hess and Surber Sampler (500 μm mesh w/300 ml bucket)		
White pans		
Kick nets		
Macro sample containers		
Preservative (70% ethanol)		
Spare nets for Samplers		
Scrub brush		
(squirt) bottles for rinsing (water and alcohol)		
Field labels		
Field Data Forms		
Rubber gloves		
Forceps		
Pencils/Indelible alcohol proof markers		
ELECTROFISHING EQUIPMENT:		
Electrofisher		
Anode and Cathode		
Dip nets		
Waders		
Rubber gloves (shoulder length)		
Specific Conductivity Meter		

Preservative: 10% buffered formalin solution		
Scales (weight (springs) & length)		
Thermometer		
Collecting Permit or IDFG personnel		
Anesthetic		
Buckets		
Gas/oil		
Generator (if using a battery powered electrofisher) + spare parts		
Specimen vouchering containers		
Fish measuring board		
Fish identification keys		
Clipboard/notebook/fish labels		
Field data sheets		
First Aid Kit		
Polarized sunglasses		
Fire extinguisher		
CPR Certification		
WOLMAN PEBBLE COUNT EQUIPMENT:		
Metric ruler (clear plastic) or angled measuring device listed in Protocol #2		
Shoulder length gloves		
Pencils/pens		
Field data sheets		
FLOW MEASUREMENT EQUIPMENT:		
Current velocity meter		

Top-setting-wading rod		
100 ft. measuring tape (minimum length)		
Rebar stakes		
Flow sheets		
Pencils/clipboard		
Waders		
Extra batteries for current meter		
MISCELLANEOUS EQUIPMENT:		
Densiometer		
2 meter rod		
Polarized sunglasses		
Tape measures		
Random number table		
Field notebook/clipboards		
Maps		
"All" forms and labels		
Sunscreen		
Camera & film		
Extra batteries		
Emergency equipment for vehicle		
First aid kit		
GPS receiver		
Current Beneficial Use Reconnaissance Project Workplan		
DEQ/Other Protocols		
Tool Kit		

Pens/pencils		

Appendix II. 1998 BURP Field Form

1998 Beneficial Use Reconnaissance Project Field Forms
Idaho Division of Environmental Quality

Site Identification

Stream Name: ______________________ Site ID: ______________ Date (YY/MM/DD): 98______

HUC: ______________ PNRS: ______________ WB ID No.: ______________

Public Land Survey: Twnshp ________ Range ________ Section ________ ______ 1/4 of the ______ 1/4 of the ______ 1/4

Latitude: ______ Degrees ______ Minutes ______ . ______ Seconds Longitude: ______ Degrees ______ Minutes ______ . ______ Seconds

Datum: NAD83 ______ NAD27 ______ Other ______ Lat/Long Confidence: 2-5 meters ______ 100 meters (raw) ______ 500 meters (estimate) ______

County: ______________ Ecoregion: ______________ Map Elevation (ft or m) ______________

Location Relative to Landmark: ______________________________

Weather Conditions: ______________________ Crew Members: ______________________

Data Collection

General Wetted Width: ______ meters Total Reach Length: ______ (20 X wetted width or100 m minimum)

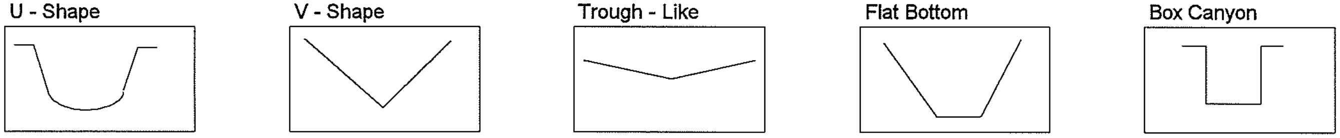
Stream Order: 1 2 3 4 5 (circle one) Stream Gradient: ______ % Rosgen Stream Type: ______

Temperature: ______ Time: ______ Amphibians Observed: ______________________

Conductivity: ______ Fish Observed: ______________________

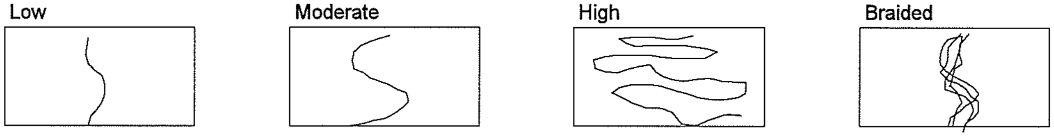
Valley Type:
circle one

U - Shape V - Shape Trough - Like Flat Bottom Box Canyon



Sinuosity:
circle one

Low Moderate High Braided



Activities Affecting Reach

Circle All That Apply:

Forestry Mining
Agriculture Roads
Recreation Urban
Diversion Grazing
Wilderness
Beaver Complex
Other: ______________

*describe all in notes

Additional Information (include riparian composition and status):

1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ______________________ Site ID: ______________ Date (YY/MM/DD): 98

Additional Information (continued):

1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ______________________ Site ID: ______________ Date (YY/MM/DD): 98 ______

Discharge Measurement

	Tape	Width	Depth	Area	Velocity	Velocity	Dischrge
	ft	ft	ft	sq ft	ft/sec	ft/sec	cfs
LWE							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
RWE							

Total Flow ______

MacroInvertebrate Samples

Were samples taken during low/stable flow period?

Yes No

Sample No. 1

Label: ______

Sampler Used: Hess Surber Kick

Habitat Sampled: Riffle Run Glide Pool

Time: ______

By: ______

Sample No. 2

Label: ______

Sampler Used: Hess Surber Kick

Habitat Sampled: Riffle Run Glide Pool

Time: ______

By: ______

Sample No. 3

Label: ______

Sampler Used: Hess Surber Kick

Habitat Sampled: Riffle Run Glide Pool

Time: ______

By: ______

1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ____________________ Site ID: ____________ Date (YY/MM/DD): 98______

Wolman Pebble Count (Modified)

Particle Size	Riffle 1		Riffle 2		Riffle 3	
	Within Wetted	Outside Wetted	Within Wetted	Outside Wetted	Within Wetted	Outside Wetted
silt/clay 0-1 mm						
sand 1.1-2.5 mm						
very fine pebble 2.51-6 mm						
Subtotal						
pebble 6.1-15 mm						
coarse pebble 15.1-31 mm						
very coarse pebble 31.1-64 mm						
small cobble 64.1-128 mm						
large cobble 128.1-256 mm						
small boulder 256.1-512 mm						
medium boulder 512.1-1024 mm						
large boulder 1024.1 mm &larger						
Total						

Large Woody Debris

Total number of pieces larger than 10cm diameter and 1m length:

*Within Bankfull

Canopy Closure

	Riffle 1	Riffle 2	Riffle 3
Left Bank*			
Center Up			
Center Down			
Right Bank*			

*Facing Upstream

1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ______________________ Site ID: ______________ Date (YY/MM/DD): 98______

Width/Depth Ratio

	Bankfull Width(m)	Wetted Width(m)	Bankfull Height(m)	Avg Wetted Depth(m)
Transect 1				
	Habitat Type:	Riffle Run Glide Pool		
Transect 2				
	Habitat Type:	Riffle Run Glide Pool		
Transect 3				
	Habitat Type:	Riffle Run Glide Pool		

Wetted Depth Measurements (m)**

** Wetted Width	# Measurements
< 1 m	3
1 m to 4 m	5
>4 m	7

Photo Information

Roll Name (Number): ______________________

Photo #:______ Azimuth______ Direction (circle one): Upstream Downstream Panorama

Photo #.______ Azimuth______ Direction (circle one): Upstream Downstream Panorama

Photo #:______ Azimuth______ Direction (circle one): Upstream Downstream Panorama

Horizontal Distance of Undercut Banks:

	Left Bank	Right Bank
Transect 1		
Transect 2		
Transect 3		

Other:

Photo #.______ Caption: ______________________

Photo #.______ Caption: ______________________

Photo #.______ Caption: ______________________

1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ____________ Site ID: ____________ Date (YY/MM/DD): 98

Longitudinal Habitat Distribution (meters)

Riffle	Run	Glide	Pool
Total	Total	Total	Total

Streambank Condition (percent)

Left Bank Facing Upstream				Right Bank Facing Upstream			
Covered Stable	Covered Unstable	Uncvred Stable	Uncvred Unstable	Covered Stable	Covered Unstable	Uncvred Stable	Uncvred Unstable

Habitat Assessment Summary Sheet

Prevalence (circle one)

Riffle/Run			Glide/Pool
1. Bottom Substrate - % fines			1. Pool Substrate Char
2. Instream Cover			2. Instream Cover (fish)
3. Embeddedness (riffles)			3. Pool Variability
4. Velocity/Depth			4. Canopy Cover
5. Channel Shape			5. Channel Shape
6. Pool/Riffle Ratio			6. Channel Sinuosity
7. Width/Depth Ratio (wetted)			7. Width/Depth Ratio
8. Bank Vegetation Protection			8. Bank Vegetation Protection
9. Bank Stability			9. Bank Stability
10. Disruptive Pressures			10. Disruptive Pressures
11. Zone of Influence			11. Zone of Influence
Total Score			

Pool Quality Index

Pool Quality Parameter	Pool Number 1	2	3	4	Code Explanation
Max Pool Depth (m)					
Tail Out Depth (m)					
Pool Length (m)					
Max Pool Width (m)					
Residual Depth (m)					<0.15m = 0 0.15m to 0.45m = 1 >0.45m = 2
code					
Avg Substrate Size (mm)					<63.5mm = 0 63.5 to 254mm = 1 >254mm = 2
code					
Overhead Cover (%)					<10% = 0 10% to 25% = 1 >25% = 2
code					
Undercut Banks (%)					<25% = 0 25% to 50% = 1 >50% = 2
code					
Submerged Cover (%)					<10% = 0 10% to 25% = 1 >25% = 2
code					
Total Score					
Ave Score					

Appendix III. Electrofishing Safety Plan

Purpose

The purpose is to ensure human safety during electrofishing operations by establishing Division of Environmental Quality competency requirements for electrofishing operations. This plan also provides guidelines for a standard operating procedure and the safe operation of electrofishing equipment.

Scope

The provisions of this plan apply to all DEQ activities using electricity (produced by gasoline powered generator/alternators or batteries) to sample animals in aquatic habitats.

Policy

DEQ recognizes the electrofishing operation as a hazardous activity for which skills and training is required. It is, therefore, DEQ policy that all personnel serving as BURP (Beneficial Use Reconnaissance Project) coordinators demonstrate knowledge of the principles and techniques of electrofishing. BURP coordinators will be considered knowledgeable of the principles and techniques of electrofishing upon satisfactory completion of the US Fish and Wildlife Service, Principles and Techniques of Electrofishing course or equivalent training.

Responsibilities.

A. The DEQ Health and Safety Coordinator is responsible for maintaining a current listing of all DEQ personnel who have attended electrofishing training.

B. The DEQ Regional Administrators are responsible for ensuring compliance with the provisions of this plan.

C. BURP Coordinators are responsible for:

(1) Providing electrofishing crews with the proper equipment and ensuring that such equipment is fully functional at the beginning of the field season.
(2) Ensuring that the electrofishing crew have and utilize the proper safety equipment.
(3) Ensuring that all crew members are first aid and CPR certified.
(4) Ensuring the availability of a well equipped, water-tight first aid kit.

(5) Discussing potential hazardous conditions encountered during electrofishing operations with crew members.
(6) Ensuring that all crew members are trained in ~~the~~ proper electrofishing techniques.
(7) Designating an electrofishing team leader.

D. Electrofishing Team Leader. Only individuals demonstrating knowledge of electrofishing techniques can serve as electrofishing team leaders. As the individuals in charge of electrofishing operations, the team leaders are responsible for following:

(1) Identifying hazardous field conditions associated with proposed electrofishing operations, determining measures to protect electrofishing team members, and appropriately briefing team members.
(2) Ensuring precautions are taken in the field to avoid harm to the public, domestic animals, or wildlife.
(3) Ensuring that all electrofishing operations cease and all crew members go ashore in the event of a inclement weather.
(4) Ensuring that electrofishing operations include only those persons necessary to conduct a safe and efficient operation and those members being trained.
(5) Reviewing the electrofishing considerations checklist and ensuring the addition of specialized items to the checklist that pertain to their Regions or operation.
(6) Inspecting electofishing equipment during the field season to assure that it is properly functioning. If repairs are needed, this must be brought to the attention of the Regional BURP coordinator.

E. All crew members must know who their leader is and recognize his/her authority as final in operational decisions. Every crew member has the right to ask questions about any aspect of an electrofishing operation. A crew member has the right to decline participation in the operation if he/she feels unsafe working in the field conditions present. Crew members are responsible for reporting all potential work hazards, accidents, incidents, and job related illnesses/injuries to their regional BURP coordinator.

Training and Education.

A. It is recommended that BURP Coordinators attend the US Fish and Wildlife Service, Principles and Techniques of Electrofishing course so that they have knowledge of the following:

(1) The basic principles of electricity and transmission of current in water.
(2) The basic concept and design guidelines for electrofishing equipment.
(3) Electrofishing equipment, the equipment's capabilities, limitations, and safety features.
(4) The safety precautions to employ while using electrofishing equipment.

B. All members of the electrofishing crew must have a current certification in cardiopulmonary resuscitation (CPR) and first aid. All crew members will be briefed in the following areas:

(1) Hazards involved in electrofishing.
(2) Safe operation of electrofishing equipment.
(3) Basic emergency procedures for drowning, unconsciousness, and electrical shock.
(4) Communication between electrofishing crew members while operating equipment.

Standard Safety Equipment
(a) All persons using portable electrofishers will wear protective gear which will insulate the wearer from electrical shock, preferably chestwaders but rubber hip boots could suffice. All footwear will be equipped with non-slip soles.
(b) Appropriate gloves will be worn and will be inspected for punctures before each use and will be replaced if damaged.
© Polarized sunglasses will be worn when there is glare on the water.

Standard Operating Procedure. All persons must be aware of the hazards involved in using portable electrofishers in running waters, such a slippery surfaces, swift water currents, deep areas, and obstacles such a logs or similar objects.

(1) A minimum of three people must be present to conduct electrofishing operations.
(2) At all times during the electrofishing operation, the crew must communicate as to whether or not the unit is putting power into the water. If a crew member must reach into the water with their hands, it is their responsibility to inform the person operating the equipment so that they can stop the operation. Communication between crew members is essential to a safe operation.
(3) Netters will work beside or behind the individual with the electrofishing equipment to ensure the electrical field is well in front of both workers.
(4) Crew members should only perform one job at a time. A person should not be carrying the bucket of fish and netting at the same time.
(5) While walking in the stream, make sure that one foot is securely planted before stepping with the other foot. Do not cross one leg over the other, especially while

walking in swift water.
(6) The individual operating the electrofishing unit should not turn the power on until all crew members are in position and have stable footing.
(7) Crew members will cease electrofishing operations during inclement weather; use discretion during rain.
(8) All safety equipment will be utilized.
(9) All operating manuals for electrofishing equipment must be available to the crew while in the field.

Portable Electrofisher Equipment Specifications and Operation. Only professionally produced electrofishing equipment should be used and the equipment should not be altered in any way.

(1) Electrodes.
   (a) Electrode handles will be constructed of a nonconductive material and be long enough to avoid hand contact with the water.
   (b) The positive electrode (anode) used with portable electrofishers will be equipped with a pressure switch that interrupts the electric current upon release.

(2) Portable Electrical Power Source.
   (a) Batteries used as an electrical power source for backpack shockers will be of the gel type that will not leak when tipped or overturned.
   (b) Backpacks will be equipped with a quick release belt (hip) and shoulder straps.

(3) Power Control.
   (a) The operator will have a switch to the pulsator or power control unit so that the electricity can be turned off quickly in an emergency.
   (b) All equipment purchased after October 1, 1985, must be equipped with a tilt switch that breaks the circuit if the operator falls.

Definitions

A. Anode: The positive electrode.
B. Cathode: The negative electrode.
C. Deadman Switch: A switch which requires constant pressure to supply electrical current to the circuit.
D. Electrofishing: The use of electricity to provide a sufficient electrical stimulus in fish to permit easy capture by netting.
E. Electrofishing Team Leader: The individual in charge of the electrofishing operation.
F. Ground: A conducting connection, whether intentional or accidental, between an electric circuit or equipment and the earth or to some conducting body that serves in place of the earth.
G. Netter: The individual who nets the captured fish during electrofishing operations.

Appendix IV. Electrofishing Training Acknowledgment Form

Idaho Beneficial Use Reconnaissance Project
ACKNOWLEDGMENT OF ELECTROFISHING ORIENTATION

I have received instruction and orientation about electrofishing from the Idaho Division of Environmental Quality. As a result, I understand and accept the following principles:

1. Electrofishing (EF) is an inherently hazardous activity in which safety is the primary concern. The electrical energy used in EF is sufficient to cause electrocution. During operations, It is critical to avoid contact with the electrodes and surrounding water. The EF field is most intense near the electrodes, but can extend outward 10-20 feet.

2. A communication system must be known by all members of an EF crew. A minimum of three people are required for all EF operations. Crew members should only perform one job at a time (e.g. a person should not be carrying the bucket of fish and netting at the same time).

3. The individual operating the electrofishing unit should not turn the power on until all crew members are in position, have stable footing, and all members agree to begin.

4. An EF operation should proceed slowly and carefully; avoid fish-chasing and other sudden maneuvers. Operations should cease during inclement weather; use discretion during rain.

5. The main power switch must be turned off immediately if an emergency occurs.

6. Rubber knee boots are minimal foot protection, as are rubber gloves for the hands. Chest waders with felt soles are recommended. Ear protection is recommended for those working near the generator. Crews will be provided with the necessary safety equipment that is in proper working condition.

7. All members of the EF crew must be certified for CPR and first aid. A first aid kit must be within immediate reach during an EF operation.

8. Stunned fish should be removed from the EF field as soon as possible, and not subjected to continuous power by being held in the field. Using the anode as a dip net should be avoided is poor electrofishing technique and potentially injourus to fish.

9. Measures should be taken to avoid harm to the public, domestic animals, and wildlife. The pulic cannot participate in electrofishing operations.

10. All EF crew members must know who their leader is and recognize his/her authority as final in operational decisions. However, every crew member has the right to ask questions about any aspect of an EF operation. A crew member has the right to decline participation in an EF operation, without fear of employer recrimination, if he/she feels unsafe in doing such work.

____

Signature of Employee Date

Appendix V. Electrofishing Check list

Backpack Electrofisher Daily Safety Inspection

Date: ____________ Stream: ____________

Electrofishing Leader ____________ Crew ID: ____________

Crew Members ____________

Manual present? Yes ______ No ______

GENERATOR/ALTERNATOR (where applicable)

____ 1. Electrical connections secure and protected
____ 2. Mountings secure
____ 3. Exhaust directed away from operator
____ 4. Oil topped up
____ 5. Gas topped up
____ 6. Engine clean - no oil or gas leaks

BATTERY (where applicable)

____ 1. Fully charged, gel type cell
____ 2. Terminals clean and tight

ELECTROFISHER

____ 1. Controls and gauges operational
____ 2. Adequate protection of wiring
____ 3. Adequate connectors and interlocking
____ 4. Audible tone generator working
____ 5. "Kill switch" working
____ 6. Mercury tilt switch working
____ 7. Anode switch working
____ 8. Wiring to anode in good condition
____ 9. Anode in good condition, fastened securely
____ 10. No screens or nets attached to anode
____ 11. Cathode in good condition
____ 12. Cathode clean, fastened securely
____ 13. Backpack frame in good condition
____ 14. Quick release buckle of backpack working

ANCILLARY EQUIPMENT

____ 1. Dip net handle made of non-conductive material
____ 2. First aid kit present
____ 3. Regulation gas containers
____ 4. Fish holding containers
____ 5. Fish measuring board
____ 6. Jars with formalin
____ 7. Fish labels
____ 8. Fish field forms
____ 9. Formalin safety equipment

PERSONNEL/CREW MEMBERS

____ 1. Each crew member briefed on unit operation
____ 2. Three or more crew members present, all CPR certified
____ 3. Each crew member wearing rubber gloves
____ 4. Each crew member wearing waders or rubber boots
____ 5. Safety precautions covered
____ 6. Local arrangements covered (land owner, Fish and Game)

Appendix VI. Vouchering Addendum IDEQ Protocol #6

Fish Vouchering Procedures

Vouchering Purpose

Vouchering of fish specimens is a quality assurance procedure at DEQ and is a routine step in "good biological science". Vouchered specimens are used for taxonomic quality control, public education, staff training, research and evidence in beneficial use attainability, status and environmental investigations. To serve these purposes, enough specimens of each species from each site should be vouchered to document the range of size and individual characteristics of each species at a site. This documentation can normally be accomplished by collecting five or six specimens of each species from the site.

Vouchering fish specimens must comply with any applicable scientific collection regulations and restrictions. The DEQ uses the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell, ID as our depository for fish (and macroinvertebrate) voucher specimens. DEQ fish collection permits need to specify the Orma J. Smith Museum as the depository for the vouchered material. A photocopy of the collection permit is also needed by the museum to document legal possession of vouchered materials.

Vouchering Procedures

Step 1: Place live specimens in 10% formalin solution as a fixing agent. Using live specimens allows the formalin solution to be ingested and respirated into the interior organs and tissues of the fish. Specimens over 300 mm (one foot) in maximum total length must have a small incision made in the abdomen and/or have formalin injected into the large muscles.

Step 2: Allow the fixed specimens to remain in the formalin solution from 24 - 72 hours depending on their size. 24 hours is normally sufficient for live specimens less than 150 mm. If in doubt, or unsure, or the fish were dead prior to placement in the formalin, leave the fish in the formalin longer. Be sure all the specimens are totally covered with formalin.

Step 3: Completely fill out two DEQ fish specimen labels with No. 2 pencil or alcohol/formalin proof pen such as the Sakura Micron Pigma. Let any ink used dry completely before placing in the sample container. Make an initial field identification of the specimens being vouchered. Place one label in with the vouchered fish. Tape the other to the outside of the sample container.

Step 4: Note on field data sheet which specimens or species are being vouchered.

Step 5: Send a legible copy of the field data sheets, a copy of the collection permit and the specimens to Don W. Zaroban (1410 N. Hilton Street, Boise, ID 83706, phone number: (208) 373-0260).

Appendix VII. Formalin Health and Safety

All field and laboratory activities will be performed in accordance with the Occupational Safety and Health Administrations requirements for a safe work place. It is the responsibility of the participants to establish and implement the appropriate health and safety procedures for the work being performed. All field staff are expected to review and understand the Material Safety Data Sheet and the Chemical Fact Sheet for chemicals of concern provided by field staff supervisors. Field staff are instructed to immediately report to their supervisor the development of any adverse signs or symptoms that they suspect are attributable to chemical exposure.

The environmental samples scheduled to be collected during this project will be obtained from surface water bodies located in natural settings. Samples to be collected include fish specimens and aquatic macroinvertebrates. The sample stations and samples to be collected are not considered to be hazardous; however, sample preservation materials include formalin (formaldehyde) which requires prudent safety precautions by those collecting samples and those coming into contact with or disposing of samples collected during this project.

Hazardous Materials (Formaldehyde)

Commercial grade formalin contains 37 to 55 percent formaldehyde. The use of formaldehyde and its derivatives are regulated under 29 CFR 1910.1048. Formaldehyde is a suspected human carcinogen. Formaldehyde is highly flammable and is incompatible with strong oxidizers, strong alkalies, acids; phenols; and urea.

Formaldehyde Exposure Limits

There may be no safe level of exposure to a carcinogen so all contact with formalin should be reduced to the lowest possible level. The odor threshold of 0.83 parts per million (ppm) for formaldehyde serves only as a warning of exposure. The permissible exposure limit (PEL) for formaldehyde is 0.75 ppm averaged over an 8 hour work shift. The time-weighted average (TWA) for airborne concentrations of formaldehyde (STEL) is 2 ppm. The American Conference of Governmental Industrial Hygienist recommend airborne exposure limit to formaldehyde is not to exceed 0.3 ppm averaged over an 8 hour work period.

Respirators shall be used when 1) installing feasible engineering and work practice controls, 2) engineering and work practice controls are not feasible, and 3) engineering and work practice controls are not sufficient to reduce exposure to or below the Permissible Exposure Limit. Respirator use should be limited to an MSHA/NIOSH approved supplied air respirator with a full face piece operated in the positive mode or with a full face piece, hood, or helmet operated in the continuous flow mode. An MSHA/NIOSH approved self contained breathing apparatus with a full face piece operated in pressure demand or other positive mode is also recommended.

Formaldehyde exposure occurs through inhalation and absorption. Exposure irritates the eyes, nose, and throat and can cause skin and lung allergies. Higher levels can cause throat spasms and a build up of fluid in the lungs, cause for a medical emergency. Contact can cause severe eye and skin burns, leading to permanent damage. These may appear hours after exposure, even if no pain is felt.

Formaldehyde First Aid

If formaldehyde gets into the eyes, remove any contact lenses at once and irrigate immediately with deionized water, distilled water or saline solution. If formaldehyde contacts exposed skin flush with water promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration if needed. When formaldehyde has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Formaldehyde Fire and Explosion Hazard

Mixtures of air and free formaldehyde gas are highly flammable. Formalin is a combustible liquid, and presents a moderate fire and explosion hazard. Use a dry chemical, carbon dioxide, water spray, or "alcohol" form to extinguish formalin fires. Store formalin solutions in insulated, closed containers in a cool, dry, well ventilated area separate from oxidizing agents and alkaline materials. Protect formalin containers from physical damage.

Formalin Spill Procedures

In case of a spill or leak, eliminate all sources of ignition, provide adequate ventilation, notify supervisor and evacuate all nonessential personnel. Neutralize spilled formalin with aqueous ammonia or mix with sodium sulfite. Wash residues with dilute ammonia to eliminate vapor. Prevent runoff from entering streams, surface waters, waterways, watersheds, and sewers.

Formalin Work Area Controls

Work area locations at stream sampling stations will be selected to ensure adequate ventilation when sample container lids are removed. Work area locations will be located downwind from field crew activities and will be isolated from field crew traffic. A single field crew member will be designated and authorized to secure the formaldehyde work area at sampling stations. This crew member will ensure proper handling of sample containers and fish specimens and will be responsible for establishing proper precautions for minimizing field crew exposure to formaldehyde at sampling stations.

Formalin Work Area Practices

Formalin (formaldehyde) is being used in this protocol for the purpose of asphyxiation and preservation of fish specimens. Pre-labeled and pre-preserved plastic sample containers will be delivered to the field crew secured in large ice chests. Field crews will transport the containers in the coolers to the field sample stations. Fish specimens will be collected by hand and place into the sample containers. Container lids will be removed immediately prior to and closed immediately after fish specimens and specimen labels are placed into the sample container. Specimens will be placed into the sample container and minimize the amount of time the sample preservative is not contained. The sample container will be placed into a large plastic bag and secured in an ice cooler until delivered to the laboratory for analysis.

Formalin Personal Protection

Field crew members within the designated formalin work area at sample stations will wear a full face shield, impervious nitrile, butyl rubber, or viton gloves, boots and aprons, etc. to prevent excessive or prolonged skin contact. Contact lenses will not be worn within the designated formalin work area. No eating, drinking, or smoking will be allowed in the designated formalin work area.

Wash thoroughly after using formalin. Avoid transferring formalin from hands to mouth while eating, drinking, or smoking. Avoid direct contact with formalin. Remove contaminated clothing and launder before wearing. Contaminated work clothing should not be taken home. Contaminated work clothing should be laundered by individuals who have been informed of the hazards of exposure to formalin.